

Math GU 4053
Introduction to Algebraic Topology
Spring 2022

Time and location: Tuesdays and Thursdays 2:40-3:55pm, online for the first two weeks and then in 417 Mathematics.

Instructor: Inbar Klang (email: klang@math.columbia.edu, office: 629 Mathematics), pronouns: she/her/hers. You can call me Prof. Klang, Dr. Klang, or Inbar.

Office hours: Tuesdays and Thursdays 1-2:30pm (online for the first two weeks and then in 629 Mathematics), or by appointment.

Teaching assistants: Undergraduate TA: Iris Rosenblum-Sellers (igr2102@columbia.edu). Iris's office hours will be held in the math help room; see here for hours.
Graduate TA: Sebastian Haney (rsh2153@columbia.edu).

Texts: There is no required textbook. We will mostly follow Hatcher's *Algebraic Topology*, which is freely available online here. We might also supplement with material from other sources, such as Munkres's *Elements of Algebraic Topology*.

Prerequisites: Topology and Introduction to Modern Algebra I, or equivalents. Introduction to Modern Algebra II is recommended as a pre- or co-requisite.

Course overview: In this class, we will cover the following topics:

- Homotopies and CW complexes (Chapter 0 of Hatcher's book)
- The fundamental group and covering spaces (Chapter 1 of Hatcher's book)
- Homology (simplicial, singular, and cellular) (Chapter 2 of Hatcher's book)
- Additional topics, such as cohomology or homotopy groups, if time permits

On help hours: An essential part of learning mathematics is asking questions. Office hours (whether the instructor's, the TAs', or those of other TAs in the help room) are an opportunity to go over material covered in class, get homework help, and ask any other class-related questions. If you are unable to attend office hours at the scheduled time, you can always email me to find an alternative time to meet.

Grading policy:

There will be weekly homework, a take-home midterm exam, and a take-home final exam (which

students may choose to replace by a group project.) Their default weight will be as follows, although there is some flexibility (see “contract weighting” below):

- Homework: 40%
- Midterm: 30%
- Final exam / project: 30%

Contract weighting. You have the opportunity to individualize the weight you would like each component of this course to have, within constraints. To opt in, email me by **Tuesday, February 1**, with subject line “weighting”, with your preferred weights. (If you do not email me, your weights will be as above.) The sum of weights must be 100%, subject to these constraints:

- Homework: 10-40%
- Midterm: 10-40%
- Final exam / project: at least 20%

There will be a “renegotiation” period (March 20-26) in which you can modify the weights of everything except the midterm.

Homework: There will be 12 homework assignments. The homework grade will be obtained as (sum of problem set scores)/10 (up to a maximum of 100%), so you can miss up to two problem sets and still obtain a full grade on homework. Please submit your homework online on Gradescope, as a pdf file, consisting of typed or neatly handwritten scanned solutions. Homework will be due every Thursday (except midterm week) at 11pm Eastern time. If you are unable to access Gradescope for this class (it is linked via Courseworks), please let me know **immediately**.

Late homework is highly discouraged, to avoid placing an undue burden on graders. I recognize, however, that this is a difficult semester; if you are experiencing extraordinary circumstances, please reach out to me and we will figure out a solution. You are allowed and encouraged to collaborate on homework, but you must write up your own solutions. Please cite any references used, other than the textbooks mentioned above.

Exams: The midterm and final exams will be take-home exams, to be submitted on Gradescope. Please submit your exam as a pdf file, consisting of typed or neatly handwritten scanned solutions. Any resources (notes, textbook, etc.) may be used, but you may not ask another person or website about a specific exam question. The midterm exam will be available from March 6 to March 13, and the final exam will be available during exam week (May 6-13.) Collaboration during exams is considered cheating and is taken very seriously. Cheating during a midterm or final entails failing the course.

Optional project. Students may choose to replace the final exam with a group project, to be completed in groups of 2-5 students. Potential project topics will be posted about halfway through the semester, and the projects will be due at the beginning of final exam week (May 6.) Projects will typically comprise of learning about a topic related to the course and writing about it. Projects must be typed, not handwritten, and must include a list of sources used. In writing the project, clarity and quality of exposition are of utmost importance; the target audience should be people who took this class a couple of years ago and therefore only remember the material vaguely.

Academic Honesty Policy: Please read the Columbia University Undergraduate Guide to Academic Integrity.

Accessibility and accommodations: Your success in this class is important to me. We all learn differently. If there are aspects of this course that prevent you from learning or exclude you, please let me know as soon as possible. We can develop strategies to meet both your needs and the requirements of the course.

If you think you might need official accommodations, I encourage you to contact the Office of Disability Services (Columbia) or CARDS (Barnard) for a confidential discussion. Once you register with them, they can provide you with an accommodation letter, which will allow you to receive official accommodations.

Student well-being: Your well-being is of primary importance. If you are facing challenges related to your physical or mental health, or obstacles like housing or food insecurity, you are encouraged to contact your advising dean and/or the Student Health Service. If you feel comfortable doing so, please do not hesitate to get in touch with me to discuss ways we can put you in the best possible position to succeed.

Inclusivity: We are part of a learning community and must treat one another with respect at all times. This is especially important with regard to race, religion, nationality, sexual orientation, gender, disability, age, size, immigration status, parental status, and any other aspect of identity. I am committed to ensuring that this class is a supportive, inclusive, and safe environment for all students, and that all students are treated with dignity and respect. See also the Columbia College Notice of Non-Discrimination [here](#).

Important Dates:

- January 27: HW 1 due
- February 3: HW 2 due
- February 10: HW 3 due
- February 17: HW 4 due
- February 24: HW 5 due
- March 3: HW 6 due
- March 10: No class (midterm)
- March 13: Midterm due
- March 14-18: No class or office hours; spring break
- March 24: HW 7 due
- March 31: HW 8 due
- April 7: HW 9 due
- April 14: HW 10 due

- April 21: HW 11 due
- April 28: HW 12 due
- May 6: Final project due / May 13: Final exam due